TRANSACTIONS OF A BANDING WORKSHOP

Agassiz National Wildlife Refuge

Middle River, Minnesota

August 25-27, 1964

Compiled by
Herbert H. Dill, Management Biologist
Bureau of Sport Fisheries and Wildlife
Region 3
Minneapolis, Minnesota

This workshop was held at the Agassiz National Wildlife Refuge, August 25-27, 1964; it had two objectives:

1. To explain the purpose of the dewline banding project and the procedures associated with banding.

2. Demonstrate techniques for waterfowl identification, aging and sexing, and the use of cannon net traps and bait traps.

The participants were queried 60 days after the sessions to learn what direct applications of techniques and principles had been made and what benefits had resulted. In all cases, participants intended to apply one or more techniques to 1965 banding projects. In some cases, immediate direct benefits of surprising proportions were reported.

For example, one State which has previously been reluctant to attempt cannon net trapping, trapped 3,300 mallards within three weeks after the workshop in an area where additional bandings were urgently needed.

Personnel from Swan Lake National Wildlife Refuge proceeded to incorporate the principles of the net used for ducks into one designed for Canada geese. The idea was to increase the number of geese captured, eliminate tangling and reduce labor. Over 6,000 geese were subsequently trapped in half the time previously required with no tangling. This work will be reported separately.

All of the participants reported a vastly improved understanding of how banding data are used to answer vital management questions. They also agreed as to the value of the techniques that were demonstrated.

It seems obvious that, as a result of the workshop, general improvement may be expected in the quality and quantity of banding data gathered from the dewline program.

Each instructor at the workshop summarized his presentation so that abbreviated transactions might be compiled for future reference. They are listed in the Table of Contents. It is suggested that this material be used for review prior to next year's banding. In the case of cannon net trapping, the safety rules in Mr. Dill's summary could be used as the subject of one or more safety meetings prior to the start of the work.

TABLE OF CONTENTS

OBJECTIVES OF THE WATERFOWL BANDING PROGRAM

INTRODUCTION

Personnel engaged in the Waterfowl Banding Program should understand its objectives and how banding data are used to answer vital management questions. This understanding is necessary to comprehend the important role that banding plays in providing the many answers required for effective management. The day has passed that banding data are used simply to determine that a bird banded "here" was recovered "there". An understanding of the banding program is essential, not only to effectively plan the program, but also to make correct decisions in the field. This understanding makes the importance of many "details" very clear, such as the necessity for accurate age and sex determinations. It should be emphasized that the banding of ducks is a sampling device to measure the characteristics of populations.

Basically, there are three major characteristics of populations revealed by banding data, each with many ramifications. First, band recoveries show the distribution of the hunting kill; second, banding furnishes information on rate of kill; and third, provides estimates of annual rates of mortality.

USE OF BANDING DATA TO DETERMINE DISTRIBUTION OF THE HUNTING KILL

Distribution of the Hunting Kill Relating to Summer and Winter Areas

It is essential that we know the distribution of the hunting kill relating to various summer and winter populations. For example, the results of the Bureau's extensive breeding ground surveys would have very little application if we did not know the harvest areas influenced by various production areas. Also, it is becoming increasingly more important to understand the distribution of the hunting kill relating to various wintering populations. This is the case for many Canada goose populations. Also, banding data

indicate that certain wintering duck populations have unique characteristics and, therefore, may be subject to special management. For example, an expanded bag limit and late hunting season has been applied to populations (principally of mallards) wintering in the Columbia River Basin in the Pacific Northwest. The effective management of summer and wintering populations requires an understanding of the distribution of the harvest relating to each population that only band recoveries can supply.

Derivation of the Hunting Kill in Various Harvest Areas

Knowledge of the proportion of the kill in various harvest areas that relates to various summer and/or winter populations is of great management significance. Knowledge of the populations furnishing the kill of various harvest areas serves as the basis for justifying more liberal regulations in some areas, or restrictive regulations in others. A recent example of this is the experimental waterfowl season in the San Luis Valley in southern Colorado. Here, banding data indicated that during October the entire kill is derived from breeding populations within Colorado. It has also been shown that after a certain date, the kill in certain areas along the Atlantic Coast is derived almost entirely from birds wintering in that specific area. The definition of areas that derive their kill from populations that differ from those furnishing the kill to other areas serves as an important basis for progressive management. It served as the justification for our present flyways. The identification of smaller areas, however, would allow the waterfowl resource to provide more recreation than would be permitted by uniform regulations throughout an entire flyway. In order to accurately estimate the derivation of the kill in a harvest area, it is necessary to weight bandings with population data. This emphasizes the importance of having the banding data relate to a period for which a population survey data are available, such as the summer or wintering period.

Distribution of the Total Hunting Kill

Use of weighted band recoveries also furnishes information on the distribution of the hunting kill when all significant populations are represented by banded birds. This information is not only valuable by itself but also furnishes information on the accuracy of population surveys.

The Mail Questionnaire Survey plus weighted band recovery data from summer and winter bandings provide three independent estimates of the size of the kill. When two agree and one disagrees, it gives us reason to look critically at the one that does not agree. In this way, it has become evident that population surveys must be missing a relatively large number of black ducks in western Ontario. Thus, in addition to providing basic information on the distribution of the hunting kill, weighted band recoveries also provide information about the reliability of population surveys. Also, weighted band recoveries sometimes point the finger at populations that are not represented by banded birds. For example, weighted canvasback recoveries from bandings on the wintering

grounds indicated a kill for Texas that was much lower than that suggested by breeding ground bandings or the Mail Questionnaire Survey. The reason for this became evident when it was noted that no canvasbacks wintering in Texas or Mexico had been banded. In addition, there are some situations where band recoveries provide the only information on the size of the kill. For example, it is essential that we have an estimate of the size of the mallard kill in Canada. Band recoveries clearly indicate that in recent years the Canadian kill was similar to that in the United States. Without banding, we would have very little understanding of the size of the Canadian kill.

USE OF BANDING DATA TO MEASURE RATE OF KILL

Definitions

Before proceeding with the discussion on the use of banding data to determine harvest rates, it is appropriate to define the various rates to which we refer in discussing banding data.

1. Band Recovery Rate - The proportion of the birds banded that are reported recovered to the Banding Office. For example, if 1,000 birds are banded of which 100 are recovered, there is a 10 percent recovery rate.
2. Reporting Rate - The proportion of bands taken by hunters that are reported to the Banding Office. For example, if half the banded birds taken by hunters are reported, the reporting rate is 50 percent.

3. Harvest Rate - The proportion of the population that is harvested. This is the recovery rate divided by the reporting rate. Thus, in the above example, the harvest rate would be 20 percent, since the recovery rate was 10 percent and half the banded birds taken were reported.

4. Kill Rate - This is the harvest rate with the addition of crippling loss. It is an estimate of the total rate of hunting kill, or the proportion of the population dying as a result of hunting mortality.

5. Mortality Rate - The proportion of the population entering a hunting season that die from all causes before the next hunting season starts. Thus, if 1,000 birds enter a hunting season and 600 die as a result of hunting mortality, disease, accidents, etc., before the next season opens, the annual mortality rate would be 60 percent.

Evaluation of Regulations

By examining the band recovery rates that occurred under various regulations, it is possible to determine the extent to which regulations affect the rate of kill. For example, it was noted in 1958, when the canvasback daily bag limit was reduced from 4 to 2, that band recovery rates from post-season winter bandings in a number of locations were reduced almost in half, thus providing valuable information that the restricted bag limit

had markedly reduced the rate of kill. It has been noted also that blue-winged teal banded in Minnesota have much higher recovery rates in years with opening dates in early October than in years with mid-October openings. In the case of lesser scaup, changes in recovery rates were independent of regulations.

Band recovery rates also can be used to evaluate the effect that closed seasons have on waterfowl survival. This can be done by comparing the recovery rates from birds banded during spans of years when the season was open with recovery rates of birds banded during periods of years in which they were closed. This is illustrated in example 1. It shows for example that of the canvasbacks banded in 1955, there was a .034 recovery rate. Birds banded in 1956 had a .077 recovery rate. Had the birds banded in 1955 all lived and been alive at the time birds were banded in 1956, they should have had the same recovery rate as the birds banded in 1956. The extent to which the two rates differ indicates the extent to which birds banded in 1955 had died prior to 1956. Thus, .034 divided by .077 indicates that 44 percent of the birds banded in 1955 survived through the year which had a 70 day season and a 4 bird limit. Now let's focus attention on birds banded in 1960 and 1961 prior to closed seasons. When the hypothetical season opened in 1962, the birds banded in 1960 had a .060 recovery rate, while those banded in 1961 had a .070 rate. Had the birds banded in 1960 all survived until 1961, they would have had the same recovery rates. Therefore, .06 divided by .07 suggests that 86 percent survived during a year with a closed season. Note also, that the recovery rate from birds banded in 1960 can be compared with that from recovery rates of birds banded in 1962 to reflect the survival during 2 years having closed seasons. In this case, .06 divided by .08 indicates 75 percent survival for 2 years of closed seasons. We are looking forward to having data from the 1963 season that can be used to evaluate the effect that the closed seasons in 1960 through 1962 had on canvasbacks and redhead survival. When an analysis of this sort was applied to white-winged dove data, clear evidence was found that closed seasons increased survival. Band recovery rates provide us with an excellent opportunity to determine the extent to which regulations influence the rate of kill.

Determination of Age Differences in Shooting Pressure

In order to fully interpret the results of the Bureau's Duck Wing Collection Survey, it is essential to know the extent to which immatures are more likely to be shot than adults. To understand the implications of mortality rate estimates, it is essential that we know the annual rate of increase. This is provided by a measurement of the age composition in the kill from the Wing Collection Survey adjusted for the greater vulnerability of immatures to shooting. A comparison of band recovery rates from immature birds with those from adults indicates the extent to which immatures are more likely to be shot than adults. For example, if immature ducks had a 15 percent direct recovery rate, while adults had a 10 percent rate, immatures would be 1.5 times more likely to be shot than adults. This means that if the age ratio in the kill was 1.5 immatures per adult, then the age composition in the pre-season population was

actually 1 immature per adult. Another example: immatures with a 14 percent recovery rate and adults with a 7 percent recovery rate. In this instance, immatures would be twice as likely to be shot as adults, thus an observed age ratio in the kill of 3 immatures per adult would indicate 1.5 immatures per adult in the pre-season population. Note that the age composition of the banded sample has nothing to do with this calculation since the comparison involves only recovery rates.

Measuring Sex Differences in Shooting Pressure

Band recovery rates also provide a means for determining the extent to which one sex of duck is more likely to be shot than another. This information is essential in order to understand the distorted sex ratios that often occur in the hunting kill. Through an analysis of band recovery rates identical to that used to evaluate age differences in shooting pressure, it is possible to determine the extent to which the sex ratio is distorted due to either an intentional or unintentional selection of one sex by hunters. Knowledge about the sex composition of the population aids in understanding the reproductive potential of a species and in interpreting breeding population survey data. This information also makes it possible to understand the effectiveness of such things as the "spare the hen" publicity program.

Species Differences in Shooting Pressure

Band recovery rates provide valuable information on differences among species in harvest rates. For example, they clearly indicate why an early experimental blue-winged teal season can be considered, while special regulations are necessary to protect canvasbacks. Band recovery rates clearly indicate the marked differences that exist among species in the shooting pressure they receive.

The Measurement of "Population" Differences in Shooting Pressure

One of the challenges in waterfowl management is to set regulations that provide the maximum possible recreational use of the resource without permitting too high a kill. Band recovery rates play an important part by indicating differences that exist between populations in the shooting pressure they experience. For example, because of differences in band recovery rates, it has become evident that black ducks wintering in New England have a much lighter shooting pressure than those wintering in the Chesapeake Bay area. Band recovery rates clearly indicate that under the same regulations different populations may be subject to markedly different shooting pressures.

Estimation of the Proportion of the Total Deaths Due to Hunting

Band recovery rates provide a basis for estimating the proportion of total deaths that are due to shooting. This is done by expanding the reported recovery rate for non-reported bands and crippling loss. For example, canvasbacks banded in Minnesota and Saskatchewan in 1953 through 1957 had a direct recovery rate of 22 percent. It has been estimated that

63 percent of the banded canvasbacks bagged by hunters are reported. Furthermore, it can be assumed that the unretrieved kill (crippling loss) was 40 percent of the bag. Thus, when the observed recovery rate of 22 percent is expanded to recognize non-report of bands and crippling loss, it indicates a kill rate of 50 percent. In other words, half of the birds going into the hunting season died as a result of hunting. This value can be compared to the total mortality rate (which was 77 percent) to indicate that about 65 percent of all deaths were due to shooting. Band recovery rates are the basic ingredients that permit the determination of the importance of hunting as a mortality factor.

Population Estimates

Band recovery rates serve as a basis for estimating pre-season population levels. This is done by using the band recovery rates in conjunction with mail questionnaire kill survey and wing collection data as illustrated in example 2. This example shows the wood duck pre-season population estimates for 2 years. This approach uses the recovery rate to estimate the rate of kill. In this instance, the rate of kill is the recovery rate doubled, since it was estimated that 49 percent of the banded wood ducks taken were reported. The Mail Questionnaire Survey indicated the size of the total kill. Since we know the size of the kill and what fraction this is of the pre-season population, it is therefore evident what the pre-season population must have been. For example, if the kill rate is 10 percent and the total kill is 10,000 birds, then the pre-season population must be 100,000. It is necessary to make these estimates separately for immatures and adults, since the different ages have different kill rates. The use of band recovery rates to make population estimates is extremely important. It provides a means of checking the accuracy of our aerial population surveys for the mallard, while for the wood duck, it provides the only source of information on the size of the continental population.

ESTIMATES OF ANNUAL MORTALITY RATES

A third major use of banding data is to estimate annual rates of mortality. This information is important for several reasons. First, when used in conjunction with information on production, it serves as a basis for determining the status of the population. For example, as soon as the relatively low mallard age ratios were known from the 1963 wing collection, it became clear that the 1964 breeding population would not show a substantial improvement. From knowledge of the annual rates of mortality coupled with information on the annual rates of increase, it is possible to deduce population trends. There often is controversy concerning the abundance of waterfowl. Therefore, it is highly desirable to have more than one source of information on the status of waterfowl.

The second major use of mortality rates in waterfowl management is to evaluate the importance of hunting as a mortality factor. Unless shooting mortality affects total mortality rates, there is little justification for adjusting regulations for changes in the status of

populations. Thus, we have been most interested in comparing recovery rates with mortality rates so that the nature of this relationship could be understood. It is possible to graph recovery rates of various populations against their mortality rates to see if the populations with high shooting pressures will also have high mortality rates. This has been done for a number of species. In most instances, there has been a direct relationship between shooting pressure and mortality rates. However, there have been notable exceptions, such as adult blue-winged teal and lesser scaup. This information obviously is of great management significance.

Example 3 illustrates how band recoveries are used to estimate mortality rates. There are a number of different ways of doing this; however, the one we use most commonly is called the Composite Dynamic Method. This method uses the number of recoveries that occur each hunting season following banding to reflect the total numbers of deaths that occur each year following banding. It assumes that hunting mortality makes up the same fraction of total deaths each year regardless of the time interval since banding. Frequently, there are more birds banded long enough to yield recoveries a short time following banding than banded long enough to yield recoveries a long time after banding. In example 2, you will note that there were 950 birds banded long enough to yield recoveries during the first hunting season after banding, while there were only 316 banded long enough to yield recoveries 5 seasons after banding. Thus, the number of recoveries each year, expressed as "recoveries per thousand birds banded," are used to portray the survival characteristics of the population. It is assumed that the recoveries reflect deaths during the entire life span of the species. Thus the number of birds that enter the first year equals the total number of recoveries. In this example: 288.4. This value is divided by the number that died during the year to indicate the mortality that occurred during the year. In the example, there was a .77 mortality rate the first year, while during the later (adult) years the mortality rate was .52. The overall mortality rate first and later years combined was .70. This last value, although it does not relate to any specific year, is of considerable interest since this is the mortality rate that must be counter-balanced by the production rate in order to maintain a stable population. In this example, since 70 percent of the population is dying each year, 70 percent of the population must consist of birds produced during the year in order to maintain a stable population. Thus, the age ratio in the pre-season population must be 2.3 immatures per adult. Thus, an extremely high rate of increase is required to maintain a stable population under this mortality rate.

In addition to providing information on the distribution and rate of hunting kill, band recoveries portray the pattern of population survival. Knowledge concerning the rate with which populations die is essential for effective waterfowl management.

GENERAL PRINCIPLES

Scope of the Banding Program

The scope of the banding program depends on the intensity with which waterfowl are being managed. If the only objective was to protect the resource, only a limited banding program would be required. However, if recognition is given to an objective of providing the greatest possible recreation, it then becomes necessary to understand the differences that exist among species and populations and their characteristics. Perhaps the greatest challenge in waterfowl management is the identification of populations that should have different hunting regulations than those applied throughout an entire flyway. This, of course, requires a banding program of sufficient scale to measure the characteristics of populations relating to parts of a flyway.

Banded Birds Are a Sample of a Population

It cannot be emphasized too strongly that the banded birds are merely a sample of the population they represent. This has a number of important implications. First, it is desirable to understand the population represented by the banding. Much more can be done with the banding data if the portion of the continental population represented by the bandings is known. This emphasizes the importance of banding at a time when winter inventory or breeding population survey data are available. However, this does not mean that banding for species that do not have this population data are not worthwhile. For example, the banding of wood duck and black duck before the hunting season provides valuable information despite a lack of population data.

In setting priorities in a banding program, emphasis should be given to those programs that band birds relating to the most important populations. The importance of the population is not only defined by its size, as is the case for the mallard, but also special management problems associated with it. For example, canvasback and redhead bandings are prompted by special management needs.

Care should be taken to insure that the birds that are banded reflect the characteristics of the population they represent. There are several considerations here. First, the banded sample should be distributed throughout the population in a representative manner. This has prompted the breeding ground banding program to be distributed throughout the breeding grounds rather than concentrated in a few localities. Also, winter bandings should sample all significant wintering populations.

The banded birds should reflect the survival characteristics of the unbanded members of the population they represent. The trapping and banding process should be one that does not increase the mortality rate of the birds. Methods of capture or handling that result in birds being released in a weakened condition should be avoided.

Furthermore, banded birds should not have conspicuous marks which affect their shooting pressure. Color marking destroys the value of band recoveries from many waterfowl. Not only do conspicuous color marks possibly alter shooting pressure, but also they distort the band reporting rates.

The first step in the analysis of banding data is the identification of the populations having different distribution and survival characteristics. It is essential that the banded birds accurately reflect the characteristics of these populations.

SUMMARY

Those engaged in a banding program should understand why banding is done, as well as the techniques used to capture and band waterfowl. The purpose of banding is to learn the following characteristics of population:

The distribution of the kill, the rate of kill, and annual mortality rates. This information is essential in order to set appropriate hunting regulations. The intensity of the banding program depends on management objectives. It cannot be emphasized too strongly that banding is a sampling procedure which requires that the population being sampled be understood and that the banded birds reflect the distribution and survival characteristics of the population they represent.

By Dr. Aelred D. Geis

- - - - - - - - - - - - - - -

CANNON NET TRAPPING

Cannon net trapping, as first described by Dill and Thornsberry in 1948, has been developed into a versatile technique for capturing large numbers of birds now used throughout the world. This lesson describes some of the factors to consider in selecting the technique, the equipment and its operation, and some of the safety factors related to the equipment and the technique.

The discussion describes the technique as physically rough and points out the risk of injury to or loss of birds and the disturbance of feeding and roosting sites. The manpower required to observe the traps during all potential shot times and to make the shot at the optimum moment and to handle the birds as rapidly as possible is also pointed out.

The discussion of equipment includes the selection of nets for two main purposes for any species. Relatively small-meshed nets are used to hold down but not entangle the birds; these are used generally on permanent sites where subsequent shots are probable and the escape of a few birds is of little consequence. Relatively large-meshed nets are used to entangle the birds on the more temporary sites where subsequent shots are not probable and the maximum number must be taken with each shot. The merits of both cotton and nylon nets are presented.

The discussion of the selection of trap sites considers the potentials of two main areas of bird-use. The loafing and roosting areas have concentrations of birds where stress and spatial requirements are minimum and where they are relatively quiescent. Feeding areas are usually more specific and may be easily developed to concentrate the birds at a desired location. Sites which may be used only once or at best, a few times, are described as "temporary"and are not suggested for development beyond clearing the net area of debris and rocks. Sites to be used frequently and especially, year after year, are described as "permanent" and recommended for development including drainage, surface and even fixed cannon emplacements.

The techniques of making the set including laying and folding the net, placing the cannons, charges and wiring hoop-ups are described. The student is informed that the shot should be made when the number of birds is adequate but not more than can be promptly removed from the nets by the available manpower. He is cautioned that the species, sex and age compositions may vary with the amount of time the birds are on a site.

The students are warned that the cannon net traps are powerful devices and to recognize the risk to the operators as well as the surroundings. Safety factors related to the handling of charges or their components, placement and loading of cannons, wiring and testing electrical circuits, stand-by and firing operations and the storage of equipment and charges are discussed.

By Harvey W. Miller

- - - - - - -

SPECIALIZED CANNON NET TRAPPING - DUCKS

The original trap (Dill and Thornsberry, 1950) consisted of a net 25 by 80 feet with 2-inch mesh (bar measure). It was propelled by three cannons of 2½-inch bore, 20 inches long. This trap was highly effective for geese and was also used for large ducks. A mixture of potassium chlorate and cane sugar was originally used as a propellant. Some operators still use the original trap, but, owing to its instability, the potassium chlorate mixture was abandoned. Black powder is still widely used, although bulk smokeless powder is recommended by Miller in certain cases. Factory loaded ammunition now on the market is loaded with smokeless powder.

The Dill-type equipment developed at the Agassiz National Wildlife Refuge has proved to be the most efficient for trapping all sizes of ducks. The improved Miller-type equipment has been widely used for geese. Thornsberry has adapted the Miller cannon for trapping Canada geese at the Swan Lake National Wildlife Refuge.

An ingenious device was demonstrated by Martin and Ellis for firing the net trap electronically from points up to half a mile distant. This has proved useful in trapping whistling swans from an inaccessible trap site surrounded by water.

A host of specifications for nets have been proposed by various people. Those found most useful are: for ducks, the Dill-type net (see appendix); for geese and turkeys, the larger meshed nets recommended by Miller and Thornsberry.

Net Trapping Ducks

The application of cannon net trapping techniques, as described in the following paragraphs, is limited to those species of ducks that will respond to bait on a dry-land site. Some workers have experimented with baited shore-lines for trapping diving ducks, but success has been limited.

The Dill-type net trap used for ducks consists of a net 27' by 65' with 1¼" mesh which is fired by three cannons. The improved Dill-type cannon weighs approximately 13 pounds; it is water tight. It has been simplified by elimination of the tube, or barrel holder. The factory-made shell is loaded directly into the end of the projectile, which is an adaptation of the ingenious firing system used by Miller.

The Dill-type net is cast by the cannons so that the leading edge furls, or tucks itself under. This is crucial to the success of the operation. The captured ducks surge to the forepart of the net, and actually assure their fate by standing on the furled portion with the bag of the net over their heads. In this way hundreds of ducks can be captured in a single cast and are easily crated in a matter of minutes for further handling.

Some important preliminary steps must first be taken if good catches are to be assured. First of all, the site selected for trapping should be near habitat extensively used by ducks! Loafing spots usually are best. However, with judicious baiting, most ducks may be induced to move from a mud flat too wet for net trapping, several hundred feet to the spot chosen.

If time permits, there is much to be said for building permanent trap sites. This is the best procedure on a refuge, or any area, where trapping will be done annually. Drawing No. 4 depicts the ideal site which has been graveled, is well drained, of uniform grade, with excellent visibility. Ducks prefer to use slightly elevated areas with water on both sides. Dikes or roadways may provide such locations. In any event, it should be free of trash and obstructions and should take advantage of the prevailing winds.

Pre-baiting for a week or more is desirable, and two or three sites work better than just one. A single trap may readily be moved by merely rolling up the folded net from each end to the center.

Schoonover advocates the use of sturdy posts set four feet in the ground as a base for the cannons. These posts protrude about 18 inches. A hole is bored at the elevation and point of aim desired for the cannon (Drawing No. 4). The posts then become a permanent part of the trap site. Thornsberry accomplishes the same purpose by elevating the

cannons on mounds of earth. Either arrangement affords several obvious advantages: improved cast, elimination of surface water, permanency of point of aim--to mention three.

The blind should be located within 250 feet of the trap so that the observer has unobstructed vision. It is important that it be exactly aligned with the net. The observer in the blind should be able to see the entire length of the folded net to permit an exact determination of the position of feeding ducks. If ducks are standing on or too close to the net when it is fired, a poor cast plus mortality and injuries is likely. This is very important, and particular effort should be made to insure adequate visibility from the blind.

It should be mentioned that the operator should plan on being in the blind before the ducks come out to the bait. This usually means getting out there before daylight. Trapping and releasing ducks toward late afternoon or evening is not ordinarily recommended. A period of daylight is desirable for the bird to readjust to its surroundings after being released. Ducks released after dark sometimes fly into wires or other obstructions, and are more susceptible to predators.

After the site has been selected and cleared and cannon posts installed a period of pre-baiting is needed. The net may be folded and left in position during this time. Wood ducks often prefer shelled corn which has been placed in the water. After feeding them there for a few days, cover the bait, thus forcing them to accept that placed on the bank in front of the trap! While oats are difficult to handle, a variety known as the Rodney oat has proved highly attractive to mallards, baldpates and teal in northern Minnesota--even more so than barley or corn.

With some species, the choice of bait and its placement becomes important. Grain broadcast into the water in front of the trap site constitutes a powerful lure. So-called "chum lines" strung for a considerable distance along the shore will often attract ducks as far as a half mile.

Nearly all ducks relish most varieties of grain, and some experimentation is probably warranted to suit individual cases. Ear corn lasts longer, however, and some species exhibit preferences.

The blue-winged teal relishes Japanese millet.

Other conspicuous items, such as the blind and holding crates, should be installed in their usual places to accustom the ducks to these things. Remember that a bushel of grain feeds approximately 125 ducks one day. Remember, too, that ducks relish (and require) grit. A ton or more of sand should annually be spread on each trap site as the ducks actually have been found to consume this much during a season!

The simplest way to set up a cannon net is to start by spreading it out on the trap site. This enables one to judge the space required. The cast of the net may be shortened by setting the restrainer pins back.

Ordinarily, approximately 35 feet is required from the water's edge to the cannons. Experience will reveal the best position for the ducks. A good rule is not to place bait nearer than two feet in front of the folded net. Do not fire the trap until all of the baited area is covered with ducks. This requires patience, and the ducks will probably flush several times before settling down sufficiently so that at least 200 (preferably 500) are in good position.

To get back to setting up--after setting the restrainer pins, stand at the center cannon post and pull the net toward you, folding it in a pile about two feet wide. Repeat this on either side until the net is neatly folded and in a straight line. It may now be draped over the cannons. This helps to keep the ducks from walking on the net. Next, the end projectiles must be pulled in sufficiently to reach the cannons. You are now ready to load.

Before loading, it is well to reflect on proper safety procedures. Electrically initiated devices are designed to be as safe to handle as possible, but, as one might expect, precautionary procedures are necessary. It is earnestly recommended that each person planning to work with a cannon net memorize and scrupulously observe the following rules:

1. Never stand in front of a cannon during arming or in front of a loaded cannon.

2. The crank for the firing source, or "hellbox", shall be carried on the person doing the arming of the cannon. This prevents accidental discharge of firing source energies during loading. If a blasting machine is used, keep it with you while loading.

3. All-firing circuit continuity should be checked with a blasting galvanometer (ohm meter). Some laboratories and commercial ohm meters can conceivably fire explosive devices. Several large explosive concerns market explosive circuit galvanometers, viz., Atlas Powder Company, Model No. 2 or equivalent.

4. All electrical connections should be of a firm and secure quality. Never minimize on the quality of electrical connections or firing cables.

5. Firing lines should always remain shunted until the area is cleared of personnel. Shunting should be maintained at the leadwires of the cartridge and the ends of the firing cable.

6. If open (unshunted) leadwires are brushed against synthetic fiber clothing, especially in cold, dry air, residual static electricity could be of such intensity to fire unshunted cartridges.

7. Radio transmission sites should be at least one-half mile minimum

distance from live circuits. Wattage outputs, climatic conditions and energy requirements are so variable that it is impossible to establish a safe minimum area. The paramount consideration should be "Never be in such a position as to be in danger if an accidental RF firing does occur". Low flying military aircraft and high voltage transmission lines under ideal conditions can also emit enough energy to trigger electrical explosive devices.

8. In the event of an unassigned misfire, a minimum of 15 minutes should be allowed before proceeding to disarm the cannon.

9. Never expose explosive device cartridges to excessive heat or abuse.

10. Transportation to and from usage sites should not be in the cabs of vehicles.

11. Interim storage of cartridges should be such that maximum personnel safety is assured in the event cartridges explode. Barrels buried in the ground or earthen mounds surrounding a wooden shack are preferred.

To load the Dill-type cannon, place the cartridge in the hole in the end of the projectile. Shape the wires carefully across the projectile and into the groove along the side. Then carefully push the projectile to the bottom of the cannon with the ramrod. Run the cartridge wires through the muzzle cover and take a turn with both wires around the ropes so that the rubber cover is seated firmly against them. (See Drawing No. 5.)

The procedure for the Miller-type cannons is similar except that the cartridge is inserted directly into the launcher and the wires are passed back to the lower end of the projectile. In all cases, care should be taken not to break the insulation on the cartridge wires. If these become bared, they may ground out, causing a misfire. Up to this point, the leadwires from the cartridge should remain shunted (the ends clipped together). If, for any reason, it is found necessary to remove the shunt-clip provided by the manufacturer, the bared ends of the leadwires should immediately be twisted firmly together. Next, with the galvanometer check each charge as well as the firing lines. If circuits are found OK, proceed to connect the charges with the firing lines, and the trap is ready.

As a matter of routine checking, make sure that all bait is at least four feet from the net. Lay a straightedge four or five feet long on top of a cannon barrel pointing in the same direction as the cannon. If the cannon is properly elevated, the straightedge should clear a bird feeding at the edge of the baited area.

Proper disposition of the holding crates will greatly aid in handling

maximum catches of 500 or more ducks. There is danger of loss and injuries from smothering and trampling, but this needn't happen if the crates are readily available and properly used. Drawing No. 4 shows a good workable arrangement. About 40 mallards in each crate constitute a reasonable load for two men. They may be loosely covered with old cotton sheeting or canvas to subdue the ducks. Each crate is set on saw horses for banding and examination of the birds. The adjustable partition makes it possible to keep the ducks within convenient reach from one end.

NOTE: The following drawings are available upon request from the Regional Office. (They were distributed at the Agassiz banding workshop.)

1. Dill-type improved cannon assembly (1964).

3. Dill-type standard net.

4. Typical trap layout.

5. Typical wiring diagram.

6. Holding crate.

By Herbert H. Dill

- - - - - - -

BANDING SITES AND BAITING

Introduction. The key to success in banding may often be the individuals willingness and ability to observe and study waterfowl feeding habits.

The Guide to Waterfowl Banding (U. S. Fish and Wildlife Service, September, 1956....a 1961 edition available) has suggestions on site selection and baits, which cover the need quite well. I have added a few notes to this.

Sites. It is better to take the trap to the bird than try to bring the birds to the trap. Site will vary with the species being trapped. The site may be on or near natural feeding grounds or on loafing or resting areas. Natural foods may cause slowness in bait acceptance... it may be desirable to select sites where natural foods are scarce, but precede with fairly long and extensive pre-baiting.

Characteristics of a good site: (1) Slope gentle and bottom firm. (2) Free of emergent and heavy growths of submergent aquatics. (Clearing may be necessary; non-selective herbicides may be used at a permanent trap site.) (3) Should be free of debris, such as logs and sticks. (4) Protected from prevailing winds. (5) Not subject to swift water currents (some desirable to prevent freezing in cold weather). (6) Near shore (usually) for dabblers...distant from shore for divers.

(7) Free of disturbance (including predators....regular trapping for birds and animal predators may be needed). (8) Gravel will increase attractiveness (can be provided artificially). (9) A fairly large water area will usually hold more birds at trap site than a small one. (10) Should be accessible to operators in all kinds of weather.

Baits and baiting. Should pre-bait for period ahead of trapping, up to three weeks, if necessary. Trap is usually left open so birds can feed close to and into it, but still escape readily from inside. Pre-baiting should often cover a wide area or stretch of shoreline so all birds in locality have chance of finding bait. Bait is concentrated in funnel, inside trap (where it may be visible from outside), and in long narrow leads to the funnels. Floating trays of bait may be useful. Corn (whole or cracked), wheat, barley, rye, sorghum, alfalfa, millet, corn silage (whitefronts) have all been successfully used as bait. Waterfowl tend to feed into the wind....remember this in baiting and trapping.

Net trapping. Have well drained slope, if possible covered with gravel. Sites on mud flats may be covered with hay, straw, or pondweeds. Site should provide some concealment for nets and cannons if trapping shy birds, such as whitefronts. See "characteristics" above.

By Merrill C. Hammond

SPECIATION, SEXING AND AGING DUCKS (Abstract)

Trapping and banding are not ends in themselves but only a means toward an end. The talents of a successful bander may be wasted if his records are in error, particularly regarding species, sex and age.

KNOW YOUR DUCKS. There are many reasons why you, a "pro" in the waterfowl management business, cannot afford to make mistakes in identification. In banding operations accurate records are the only usable kind. In public relations work and court cases, you are supposed to be the expert. We're all paid to know our ducks.

Worldwide there are 247 forms of swans, geese, and ducks including 147 full species. For North America, Kortright lists 62 kinds but most banders deal with a dozen or less. These, however, may differ in appearance as they grow older as well as between sexes. Occasionally they hybridize or you may run into off-plumages or exotics. Thus there are many possibilities which may prove baffling if you are uncertain about identification.

Fortunately, there are many aids to identification. A number of good books are available which will enable you to get acquainted with species or plumage which you seldom see. Kortright in The Ducks, Geese, and Swans of North America goes well beyond that and shows how the various external and internal characters may be used to sex and age the birds

as well as speciate them in various plumages. Usually the wing alone is a giveaway as to species, age, and sex (covered in detail in another lesson). If you find one or more notched tail feathers, you are sure that the birds were hatched that year. Hen dabblers, except baldpates and wood ducks, usually have dark spots or blotches on the bill; while drakes rarely have them. Light specks usually mean a young hen while heavy blotches mean an older one. Leg color is another aid in aging and sexing dabblers. These aids will help you make a decision but if there's any doubt, use cloacal examination for sex and age. It is absolutely essential that the duck bander master the cloacal aging technique since there will be times that other techniques will not give dependable results.

(60 slides used to test the individual's ability to speciate, age, and sex ducks and also to point out various identification aids and techniques.)

By A. S. Hawkins

- - - - - -

SEXING AND AGING WINGS

The background of the development of the wing analysis technique was explained to the class, together with some applications in managing waterfowl. It was pointed out that wings obtained in the wing survey collections come from birds taken later in the fall, when hunting seasons are in full swing. It was also pointed out that characters present on wings taken later in the fall might not adapt themselves to sex and age determinations during dewline banding because wings of birds taken that early might be confused with molting adults. Students were cautioned that this technique in banding should be considered as just another aid in determining sex and age, and that it might not in itself be conclusive.

A series of slides were shown, representing known sex and age wings from all species of puddlers, and most species of divers. Instruction was also given on the general techniques used for determining sex and age of each species. This was done from the slides, which did not permit careful study of the various characters. Students were, however, told what to look for and what characters were used in the determinations.

Following the slide talk, a collection of known-age and sex wings from mallards and blue-winged teal (the species currently most important in the dewline banding program) were distributed, and instructions given the group on how these wings could be sexed and aged.

That afternoon, when the group participated in the actual banding of birds caught in the morning, the wing techniques were again demonstrated on the live birds. With the exception of one questionable blue-wing male, the wing determination was verified by cloacal examination. Thus, it was demonstrated that this technique could be a useful tool in the banding program, at least on birds as far advanced as those worked on that day.

By Dr. Wm. E. Green

- - - - - -

BAIT TRAPS

A series of slides were used in this presentation, showing diagrams and actual color photos of over 25 different types of bait traps which have been effectively used in various parts of the United States and Canada.

Along with the slides, a discussion of the relative merits of each trap was given, such as habitat used in, baits used, construction details of the traps, the species for which each trap was used, and the person or persons who either developed or modified each type of trap.

It was pointed out that these represented only some of the traps known to be effective under certain conditions, and not necessarily all of the types in use; neither was it to imply that these designs were the last word. The various types were shown and discussed to give the group some idea of what general designs have been found effective, with the idea that those in attendance might either use some of the actual designs, or at least get an idea of a type which might work in their own particular case. It was also pointed out that we would expect many of the people in the room could take one of these designs and modify it so that it would be more effective in his own area, or under conditions under which he would be trapping.

The presentation evoked considerable discussion from the floor, not only on the use of the designs illustrated, but also in presenting new and different methods of capturing birds, using designs which were not covered in the original presentation.

By Dr. Wm. E. Green

DRIVE TRAPPING DUCKS

Non-flying ducklings (locals) and moulting adult ducks may be captured by herding them into traps. Knowledge of habitat, species psychology, and probable behavior of the particular birds involved are most important. While there is a general plan of operation the crewleader must recognize the variables in each situation and be resourceful in adapting the modus operandi to meet particular needs. Broods are usually well distributed, often widely dispersed, and mobility of the crew is usually necessary. Portability of equipment is essential.

Reconnaissance is necessary. Preliminary observations should determine locations where drive trapping efforts might succeed, and the period during which birds will be at suitable stages of development. Aerial reconnaissance is most useful but needs to be supplemented (and verified) by ground observations. Requests for information from all possible cooperating sources will provide useful leads. Reconnaissance should continue during the trapping period.

The number of men constituting a crew may consist of as few as three or four, or as many as more than twenty. Equipment may consist of only a few rolls of poultry wire, or of ready made trapping gear. It may include

boats, aircraft and a number of specialized items. A crew of six men, using two or three motor vehicles (one of which should be a pick-up truck, or include a utility trailer), and two or three cartop boats with weedless outboard motors, can handle a good percentage of the water areas which may be encountered. Many of the drives, or most, are made by wading. Boats are needed on deep or large water areas.

Puddle ducks attempt to escape by sneaking off or hurtling into escape cover which is emergent from or lining the water. Crewmembers must move to surround the water area immediately upon arrival at the scene, thus frustrating such escape attempts, and holding the birds out on open water. Diving ducks will move to the middle of the open water. Commotion should be held to a minimum so as not to panic the birds, causing them to dive or rush blindly over water to escape on shore. Crew members must be able to recognize species involved, anticipate behavior, think independently, and coordinate their actions intelligently to implement the operation indicated in each situation.

With the birds held on open water, two or three crew members set up the trapping equipment as directed by the crew leader. The determination as to how and where to set will be made on at least the following factors: species involved, water depth, convenience (distance gear and later ducks must be transported, anounts of muck to be waded, etc.), direction and velocity of wind, size of area to be worked, probable number of birds to be captured, personnel capacities, and other considerations. If only puddle ducks are involved, the trap can be set on shore or near shore. If diving ducks are involved, it is usually necessary to set the trap well off shore. In all cases, the guiding theory is to get the birds into a position where they feel somewhat constricted and uncomfortable. This is often done prior to setting the trap. The trap is placed in a location where the birds will want to go naturally. Thus, they are permitted to "escape" into the trap. And, actually, the operation is more a matter of guiding the birds than of driving them.

A so-called "Manitoba Trap" and several sections of leads often constitute a basic outfit. Trap dimensions are approximately 2-1/2 x 5 x 10 feet. The trap is constructed of one inch nylon netting on aluminum tube frames and contains an entrance throat. Leads are constructed of six foot high netting hung on eight foot long aluminum rods of 5/8 inch diameter. All netting is hung square. Hoops, or frames, in the trap are spaced two feet apart. Rods, or poles, in the leads are spaced ten feet apart.

By F. Charles Kniffin

- - - - - -

HANDLING AND IDENTIFYING DUCKLINGS

After capture by drive trapping, ducklings are wet in varying degrees and emotionally affected by the traumatic experience. They should be handled gently and carefully. They should be sorted by species and held in pens or containers which will not allow injury, and should be

watched to prevent pile-ups and suffocation. If trapping was for banding purposes, this should be expeditiously accomplished and the birds released on the water where caught. Trapping should be completed early enough in the day that ducklings will have a few hours of daylight and warmth in which to preen and dry their plumage before the onset of night. They should not be trapped in the rain, and if possible, not released in rain. There can be no justification for handling birds roughly, throwing them into the air, onto the water, or the ground, at time of release. They should not be dropped in the vicinity of men or equipment, as some will "hide" and be stepped on. They should be carried to the water and gently released.

Identification of ducklings is difficult. It cannot be presumed that great familiarity with adult ducks will enable accurate duckling identification. Ducklings change during development, sometimes rapidly and radically. In some cases, recognition features useful with adults persist in ducklings. In others, they do not. When dealing with only a brood or two, it is usually possible to make identification via the hen. Even if not captured, the hen was noted with her brood prior to capturing the ducklings. This is usually sufficient evidence to warrant identification. In the case of canvasbacks, each duckling should be scrutinized, however, as these broods often include reheads.

When identification must be made without reference to hens, the birds may be keyed out. First, they are separated into diving duck and puddle duck groups. In addition to the lobed toe feature, diving ducklings do not show a dark stripe through the eye. Puddle ducklings lack the toe lobe and demonstrate an eye stripe.

Considering individual ducklings within the two broad groups, there are a number of individual features which are unique or peculiar in combination with other features. Some features characteristic of puddle ducklings are noted herewith.

Mallard	Sturdy orange legs; flesh-colored edge on basal portion of bill; mallard type head-bill conformation.
Gadwall	Pale yellow (not orange) legs; yellow edging full length of bill.
Pintail	Streamlined pintail conformation, blue-grey bill and legs; reddish wash on sides of head in young ducklings; black and grey coloration. (Note: Most puddle ducklings are black and yellow.)
Baldpate	Very dark on back; blue-grey bill and feet. Bill is rather high-bridged; reddish wash on sides of head.

Blue-winged teal	Tiny-solid blue grey bill; legs color of dirty water with hint of yellowish tinge.
Green-winged teal	Tiny - no hint of yellow in leg color; flesh colored edge along basal portion of bill; very young ducklings show double eye-stripe.
Shoveller	Spatulate bill; not as husky as mallard at given stage of development.

Some diving duck features: Lesser scaup - very dark on back, short broad bill, somewhat similar in general appearance to local baldpate but a diver; Canvasback - typical head-bill profile, husky for given feather development stage; Redhead - not as husky as canvasback, lacks straight profile of canvasback, has shorter nostril than canvasback which is quite long and narrow, is almost golden color as very young duckling; Buffleheads, Goldeneyes and Scoters have a generally similar pattern of black and white markings, but birds can be separated by general size and species characteristics. Little ringneck ducklings are quite buffy on the side of the head (scaup are dark), and both species tend to resemble the adults as they approach flight stage.

By F. Charles Kniffin

- - - - - -